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Texas Agricultural Extension Service

Texas Citrus Orchard Establishment

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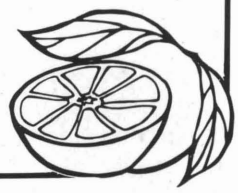

Site Selection

Major factors which determine the suitability of a particular site for citrus establishment are soil, water, topography and the closely related factors of salinity and drainage.

Soils

The Brennan, Delfina, Hidalgo and Willacy soil series comprise the major acreages of soils which are well-suited to citrus production, although smaller acreages in other soil series also are well-suited for citrus. An examination of local soil survey maps can provide useful information about a potential orchard site.

The best citrus soils are coarse sandy loams to fine sandy clay loams, deep and well-drained, with a ground water table at or below the 5-foot depth. Salinity should be less than 2 millimhos per centimeter. Soil pH normally will be in the range of 7.0 to 8.2. Soils containing more than 30 percent clay in the upper 2 feet generally restrict root development, tree size and orchard productivity.

Occasional relatively impermeable clay lenses may occur in otherwise suitable soils. In such cases, drainage installation is necessary to prevent salinitiy accumulation and high water table, either of which could severely restrict root growth and, thus, affect overall tree vigor and productivity.

Topography

The principal citrus-producing counties of Cameron, Hidalgo and Willacy are situated in a flat and featureless plane with poor natural drainage. Elevation increases from sea level at the coast to 37 feet at Harlingen, 75 feet at Weslaco, 96 feet at Edinburg and 225 feet at McCook.

Although terrain features are poorly defined, they should be used where possible. Existing slight differences in slope and elevation determine the rate of cold air movement into or away from a site on calm, clear nights. During radiational freezes with wind speeds under 4 mph, cold air will settle in the lowest area, resulting in temperatures a few degrees lower than in higher surrounding areas. During advective freezes and strong northerly winds, orchards on exposed northern slopes and atop small ridges may be subjected to colder temperatures than those occurring on southern slopes.

Water

Citrus requires about 50 inches of water annually. Average rainfall across the Valley normally provides less than half of the annual water requirement. Consequently, irrigation is necessary to provide 25 to 40 inches of water annually to supplement existing rainfall.

The major water source for the Valley is the Rio Grande River and its storage reservoirs at Falcon Lake and Lake Amistad. This water is allocated to both Texas and Mexico for municipal, industrial and agricultural use. Depending upon annual rainfall in the Rio Grande watersheds, water shortages occur and may become quite severe. All water from the river is apportioned by allotment from the respective irrigation districts.

Rio Grande water is considered moderately saline, usually containing 500 to 1,000 ppm total salts. However, river water may exceed 1,700 ppm total salts during certain seasons in some areas.

Very little ground water is used for citrus irrigation in the Valley, although suitable well water does exist. Generally, wells containing 300 to 1,200 ppm total salts, less than 1 ppm boron and a sodium adsorption ratio (SAR) less than 8 will not limit citrus production on well-drained soils, particularly with sour orange rootstock. Well water having an SAR of 8 to 15 is considered marginal.

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Salinity and Drainage

Potential orchard sites should be checked for salinity. Those with salinity below 1,280 ppm in the soil saturation extract should pose no problems for citrus. Those with a salinity level up to 2,560 ppm can be productive with intermittent leaching and more frequent irrigation.

Because salinity can increase in soils under Valley conditions, careful management of irrigation and drainage is essential to good citrus productivity. Each irrigation should provide adequate water to replenish the soil reservoir, with an occasional excess irrigation to provide leaching of accumulated salts from the root zone. Moreover, the normally heavy rains in May and September provide thorough leaching.

Internal drainage and depth of the water table should be checked before planting. Excessive free water in the soil profile because of poor drainage results in poor aeration, poor soil structure and excessive soluble salts. Such problems in existing orchards may not be recognized until trees begin to defoliate, become less productive or show die-back and poor growth.

Surface drainage is provided during land preparation and installation of an irrigation system. Subsurface drainage, if needed, must be designed and installed to remove excess water to drainage outlets or to collection points where it can be pumped into drainage ditches.

Land Preparation

Orchard sites should be leveled to the appropriate grade to facilitate uniform water distribution and surface drainage. Assistance in planning land leveling can be obtained from the Soil Conservation Service. After leveling, the soil should be deep-chiseled to break up compacted areas and surface hardpans, then disked thoroughly in preparation for planting.

Orchard Design and Spacing

It is generally accepted that a north-south row orientation provides better production and fruit quality than an east-west orientation. Moreover, single rows of trees have proven more feasible to manage than various configurations of double-row plantings.

Although few high-density commercial plantings exist, the long-term trend toward closer tree spacings continues. Obviously, more trees provide more fruit per acre during establishment years. In addition, high densities are considered to have better cold protection and may reduce windscarring of fruit. However, closer spacings are more expensive to install and require more intensive management at maturity to control tree size and maintain optimum productivity.

Young citrus orchard.

The most common row spacing is 25 feet. No orchards are being set wider, but some orchards are being planted at row spacings of 24 or 22 feet. The minimum row width is dictated by final tree size to be maintained and the space required for orchard care equipment and harvest operations.

In-row spacings of 12.5 and 15 feet are most common, but some closer and/or wider spacings exist. Minimum in-row spacing is determined by the economics of nursery tree costs, young tree cold protection costs and subsequent pruning and/or tree removal costs.

Table 1. Trees per acre at various spacings (in feet).

Row width	In-row spacing 8	9	10	11	12	13	14	15	16
20	272	242	218	198	181	168	156	145	136
21	259	230	207	189	173	160	148	138	130
22	247	220	198	180	165	152	141	132	124
23	237	210	189	172	158	146	135	126	118
24	227	202	181	165	151	140	130	121	113
25	218	194	174	158	145	134	124	116	109

Planting

Most citrus trees are planted from October through May, although planting at any time can be successful if the trees are given the proper care for the season. The orchard site should be laid out and planting holes dug prior to receiving the trees.

Field-grown Trees

The tops of field-grown trees are pruned substantially at digging to bring them into closer balance with the reduced root systems. Trees should be planted as soon as possible after digging. Root balls should be watered periodically if the trees must be held for several days between digging and planting.

Fall planting allows reestablishment of the root system prior to spring growth, although very early planting could result in succulent growth that is easily damaged by later cold weather.

Late December and January planting is excellent because the trees should be completely dormant, and the weather is usually cool enough that top growth is not initiated until the period of greatest freeze danger is over.

Planting from February through May does not allow adequate time for root establishment before top growth begins, so more frequent irrigations must be applied to carry the trees through the heat of late spring and summer.

At planting, the top of the ball should be set level with or slightly above soil level. The hole should be filled and tamped about half-full. The string at the top of the ball should be cut to allow the burlap to be folded down into the hole for quick deterioration. The hole is then completely filled and tamped to eliminate air pockets. Newly planted trees should be watered immediately to settle the tree and soil and provide the initial moisture needed for establishment.

Container-grown Trees

It is preferable to delay planting of container-grown trees until February. Earlier plantings are successful, but such trees may quickly resume growth in the field and, thus, be subject to cold damage in the winter.

The major concern in planting container-grown trees seems to be the slowness of the root system to move out of the original medium and into the surrounding soil, thus requiring more intensive irrigation until the trees become established. However, this situation can be greatly alleviated by the removal of the outer 1-inch layer of soil-less medium at planting. This allows the outer parts of the root system to be placed in direct contact with surrounding soil and the trees become established quickly. Even so, intensive irrigation management is essential.

The top of the root system should be set at or slightly above soil level. Either the top 3/4 inch or so of medium should be removed and replaced with soil at planting or a 3/4-inch layer of soil should be placed over the medium as the final step in planting. The soil-less medium has very good drainage; i.e., it contains considerable air space. Without sealing off unrestricted air movement into and out of the root ball, the medium will quickly dry out, causing moisture stress of the tree even though surrounding soil is quite moist. Trees should be watered immediately following planting to settle the tree and soil and provide the initial moisture needed for establishment.

Newly planted tree with water ring.

Irrigation

Young citrus trees require intensive irrigation management to prevent moisture stress. As a general rule, irrigation is applied every 7 to 14 days during the first few months of establishment, after which the frequency may be 10 to 21 days during the summer months.

Obviously, irrigation frequency depends upon soil type, prevailing weather and type of irrigation system. Growers are expected to modify irrigation frequency based upon these factors and experience. However, to maintain optimal growth and to maximize water use efficiency, growers should utilize soil moisture sensors to accurately assess the need for irrigation.

Nutrition

Nitrogen is the only major nutritional element that must be applied to Valley citrus, although micro-element deficiencies may require correction. Fertilizer should be first applied when growth resumes following planting and periodically thereafter until a couple of weeks prior to normally occurring growth flushes. The fertilizer should be

evenly distributed atop the soil over the expanding root zone.

General recommendations are 1/8, 1/4 and 1/2 pound of actual nitrogen per tree annually for the first, second and third years, respectively. However, some growers routinely apply higher amounts with good success during establishment.

Weed Control

Complete weed control around young citrus trees is essential because weeds can severely reduce tree growth and development by competing for available moisture, nutrients and sunlight.

Although mechanical means of weed control are still used, the majority of young orchards are established under chemical weed control, particularly in strips along the tree row. A number of proven herbicides, both pre-emergent and post-emergent, are available for use in young citrus.

Pre-emergent herbicides normally are applied during early spring and late summer, whereas post-emergent materials are applied as needed to control those weeds which escape the pre-emerge program. Good herbicidal weed control may be difficult to attain in the first season.

Pruning and Training

Young citrus trees normally are pruned and trained in the nursery. Consequently, little pruning is required during establishment. Most pruning is limited to the removal of trunk sprouts and occasional twig dieback. Water sprouts that outgrow the rest of the tree can be removed or cut back.

Orchard Productivity

Orchard productivity can vary considerably because of natural causes, rootstock-scion combinations and level of management. However, general production estimates are essential for management decisions. Estimates based on historical production data in Texas orchards can be used by growers to project production trends.

The data in Table 2 are based on standard orchard density of 115 to 120 trees per acre, under three levels of management. Orchards of higher density should produce somewhat higher yields, within limits, in the first 3 to 7 years. Obviously, yields may vary in any given year because of weather and general orchard care.

Table 2. Tons of citrus produced per acre under three levels of management.

	Grapefruit			Orange			Valencia		
Age	Fair	Ave.	Very good	Fair	Ave.	Very good	Fair	Ave.	Very good
3	1	3	6	1	2	4	1	2	3
4	3	6	10	2	5	7	2	3	4
5	5	9	14	4	7	11	3	4	7
6	7	14	19	5	10	13	4	7	10
7	8	18	23	7	13	16	5	9	13
8	10	20	26	8	15	19	6	11	15
9	11	22	27	9	17	22	7	13	17
10	12	23	28	10	18	24	8	14	18

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